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मानक

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“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 8749 (2002): Biogas Stove [MED 23: Domestic and Commercial Gas Burning Appliances]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक
बायोगैस स्टोव — विशिष्टि
(दूसरा पुनरीक्षण)

Indian Standard
BIOGAS STOVE — SPECIFICATION
(*Second Revision*)

ICS 97.040.20

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAMIN
NEW DELHI 110002

August 2002

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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1978. The revised standard has been divided into three sections. Section 1 covers construction, Section 2 covers performance and Section 3 covers general requirements of the stove. Keeping in view the present manufacturing techniques in the country, the requirements for materials, design, maintenance and finish have been changed accordingly. In the first revision suitable test for components of plastic materials and vitreous enamelled components and requirements for gas taps have been added. The standard has also been brought in line with the requirements covered in IS 5116 : 1996 'Domestic and commercial equipment for use with LPG — General requirements (*third revision*)'. In this revision, use of air for gas consumption has been made and strength test has been modified. This standard is being revised to incorporate the amendments issued and the suggestions received from time to time.

Biogas is obtained by anaerobic fermentation of cattle dung and other similar agricultural organic waste. While attempts to increase the yield preferably incombustible constituents, such as methane and hydrogen, are being encouraged it is also of equal importance to give consideration to safe, efficient and economic utilization of the gas thus obtained. It is expected that this specification will be helpful in achieving this objective. Requirements for design and installation of biogas plant are covered in IS 9478 : 1989 'Family size biogas plant — Code of practice (*second revision*)'.

The composition of the Committee responsible for formulation of this standard is given in Annex J.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

AMENDMENT NO. 1 APRIL 2003
TO
IS 8749 : 2002 BIOGAS STOVE — SPECIFICATION
(*Second Revision*)

(*Page 1, clause 5.4, line 3*) — Substitute 'Metals' for 'Details'.

(*Page 8, clause 14, lines 4 and 5*) — Substitute '3.92 kN/m²' for '14.71 kN/m²', and '40 gf/cm²' for '150 gf/cm²'.

(ME 23)

Reprography Unit, BIS, New Delhi, India

Indian Standard
BIOGAS STOVE — SPECIFICATION
(Second Revision)

1 SCOPE

1.1 This standard covers construction, operation, safety requirements and tests for stoves intended for use with biogas.

1.1.1 For convenience, this standard has been divided into three sections as follows:

Section 1	Construction
Section 2	Performance
Section 3	General

2 REFERENCES

The standards at Annex A contain provisions which, through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards.

3 TERMINOLOGY

For the purpose of this standard, definitions given in IS 6480 shall apply.

SECTION 1 CONSTRUCTION

4 GENERAL

4.1 Construction of all parts of the equipment shall be sound and of a high standard of workmanship and appropriate finish. Construction shall ensure durability and shall comply with the safety requirements.

4.2 Rivets, fastening screws, plug, etc, shall not lead into gas passages except where adequate provision has been made to ensure permanent gas-tight joints.

5 MATERIALS

5.1 Fittings and materials shall comply, wherever specified, with the relevant Indian Standards and shall be appropriate to the conditions arising in the part of the stove in which they are used. The stove shall be free from scarf, grit and other foreign matters. Wherever possible, rigid metal tubing shall be used for internal gas supplies integral with the stove. If flexible tubing is used, it shall not be fitted on the outlet side of any control which is capable of cutting off the gas completely; except when metal connections are fitted. The use of low pressure suitable or plastic tubing fitted or pushed on nozzle is not recommended.

5.1.1 Plastic components, which are liable to heating (for example, tap handles, push buttons, etc) shall be free from fissures, distortion, blemishes and discoloration and shall not show signs of ageing when tested as covered in Annex B.

5.2 The materials used in the construction of the stove or parts shall be resistant to wear and deterioration occurring in normal use and the burner parts shall not melt or distort when the stove burner is operated with flames flashed back for half an hour in the mixing tube. This shall be checked by the test detailed in Annex C.

5.3 All copper and copper alloy parts shall pass the mercurous nitrate test (season cracking test) when tested according to the method specified in IS 2305.

5.4 The main body of the burner (including mixing tube and burner head) shall be of durable construction. Details having a melting point below 510°C shall not be considered acceptable for the burner head and the mixing tube.

5.5 The components of the gas taps and the nozzles may be made of the following material:

<i>Com- ponent</i>	<i>Manufac- turing Process</i>	<i>Material</i>
Body	Hot forged	Brass-bars (<i>see</i> IS 6912) or Free cutting brass (<i>see</i> IS 319)
Body	Casting	Brass (<i>see</i> Grade 3 of IS 292 or Bronze (<i>see</i> Class V of IS 1458)
Plug, nuts and screws	Machined	Free-cutting brass (<i>see</i> IS 319)
Pins	Machined	Free-cutting brass (<i>see</i> IS 319) or Stainless steel [<i>see</i> IS 1570 (Part 5)]
Springs	—	Stainless steel [<i>see</i> IS 4454 (Part 4)]
Washers	Cold pressed	Brass (<i>see</i> IS 410) or Aluminium (<i>see</i> IS 737)
Nozzles	Machined	Free-cutting brass (<i>see</i> IS 319) or Mild steel or Stainless steel

NOTE — The relevant Indian Standards referred to in the table are given in the following table.

5.6 The components of the gas taps and the nozzles shall be made of non-corrosive material or appropriately treated to resist corrosion.

6 DESIGN FOR MAINTENANCE

6.1 The stove, including all the component parts, shall be easy to clean and to maintain in a good working order. There shall be easy access to the accessories and controls for maintenance and adjustment.

6.2 Burners and parts of burners only of same rating, model and make shall be interchangeable or replaceable without affecting the performance.

6.3 Parts, which are intended to be removable by the user, shall be easy to replace correctly, and difficult to assemble incorrectly.

6.4 All nuts, bolts and fittings having spanner flats shall be capable of being moved by suitable spanner or be readily accessible to an adjustable spanner.

6.5 The parts of the burner shall not become disconnected during operation of the appliance. The burners should be so spaced that the relative distance between the centres of the adjoining burners shall be not less than 250 mm.

6.6 Burner ports shall be so designed and located that in normal use, spillage of food shall not cause internal fouling of mixing tube and/or blockage of injector jet.

6.7 It shall be possible to adjust the air shutter by the consumer easily without the use of special tools. The design of the air shutter shall ensure that adjustment will not change by itself. Means shall be provided to ensure that primary aeration is not completely excluded.

7 RIGIDITY AND STABILITY

The stove shall be so designed that it remains stable and shall not be easily overturned.

8 GAS TAPS

8.1 The stove shall have at least one gas tap for each burner.

8.2 The 'ON', 'OFF' and any fixed position of tap handles shall be clearly and durably indicated or shall be obvious by design or position (*see* Fig. 1). Where it is not obvious which tap operates which burner, some indication shall be given. All taps shall close in the same direction. Taps shall be designed so that when placed in any position and viewed from a distance of 3 m, will definitely indicate whether the tap is open or closed or in intermediate position. The direction of rotation of a tap knob (handle) from off-on-simmer shall be anti-clockwise.

8.3 Where taps are fitted with adjustable stops, there shall be means for locking the stops in position. If screws are used for this purpose, these shall not lead into gas passages.

8.4 All taps should lock in the 'OFF' position and it shall be impossible for any tap handle or knob to move accidentally by the weight of plugs or handle or when caught by clothing. If this requirement is satisfied by means of an automatic locking device, the tap shall be easy to operate with one hand.

8.5 Taps shall be so made that in normal use and with reasonable application of lubricant, gas passages do not become blocked (*see* Fig. 2).

8.5.1 Taps shall be lubricated with suitable grease, resistant to the action of biogas and capable of operating up to a temperature of 80°C.

8.6 Each taper plug tap shall be spring-loaded to maintain a gastight fit. Helical springs fitted in tap shall be made of stainless steel material and shall have flattened ends which shall be rounded before fitting.

8.7 Taper plug taps shall have dimensional allowances when in 'OFF' position as given in Fig. 3.

8.8 All controls or taps shall be easy to operate at all temperatures normally attained to use.

8.9 Screws, nuts, etc, which regulate the tension of the taps or valve springs, shall not loosen in the operation of the stove. It shall not be possible to cause a leak during manual operation of the tap.

8.10 Taps shall have positive stops at 'OFF' and 'SIMMER' position.

8.10.1 Simmer flame, if provided, shall be obtained by fixed simmer orifice.

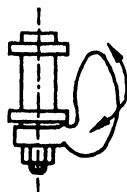
8.11 The niting means adopted shall be sufficiently robust to withstand normal use without distortion or damage.

9 FINISHES

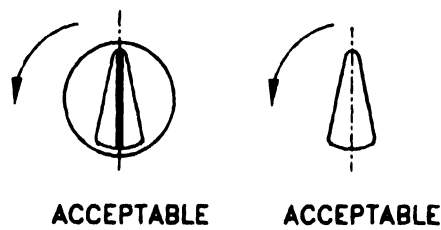
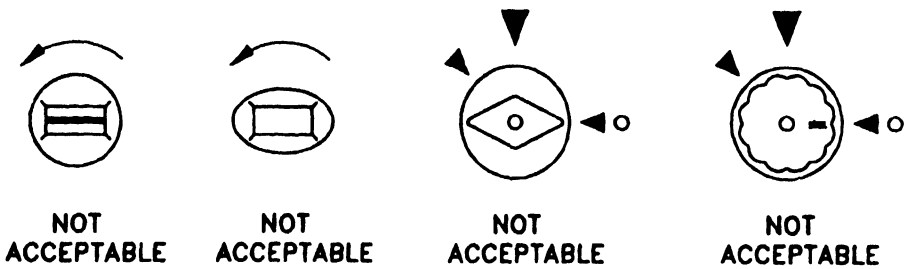
9.1 The finish of exposed parts shall be durable, easy to clean and not subject to excessive deterioration in normal use. Parts, which will come in contact with the foodstuff, shall be capable of being hygienically cleaned. The finishes shall, on visual examination, show no defects, such as pin-holes, blisters, roughness or exposed areas of metal, which would give rise to unduly rapid deterioration in use. The finished components shall meet the requirements covered in 9.2 to 9.4.

9.2 Vitreous enamelled components shall meet the requirements as given in Annex D. The test shall be carried out on a specimen measuring 40 mm × 75 mm prepared from the same base metal and enamels, as the components, and processed and fired along with the components to ensure identical conditions.

9.2.1 A separate specimen shall be used for each test.

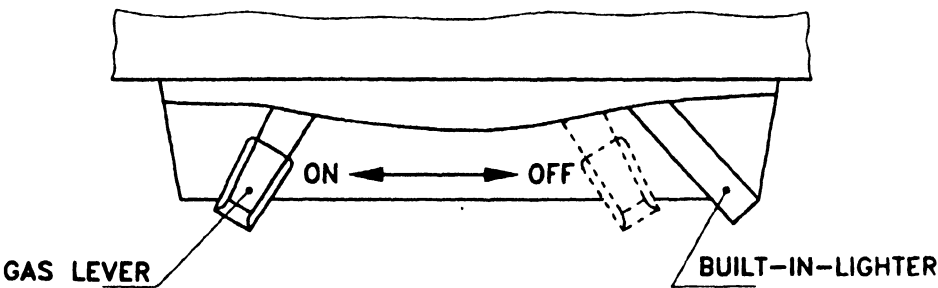


TYPE A TURNING AXIS VERTICAL



ASYMMETRICAL

TYPE B TURNING AXIS HORIZONTAL AT
RIGHT ANGLE TO FRONT OF STOVE



TYPE C MOVING KNOB IN THE HORIZONTAL

FIG. 1 TYPES OF TAP HANDLES

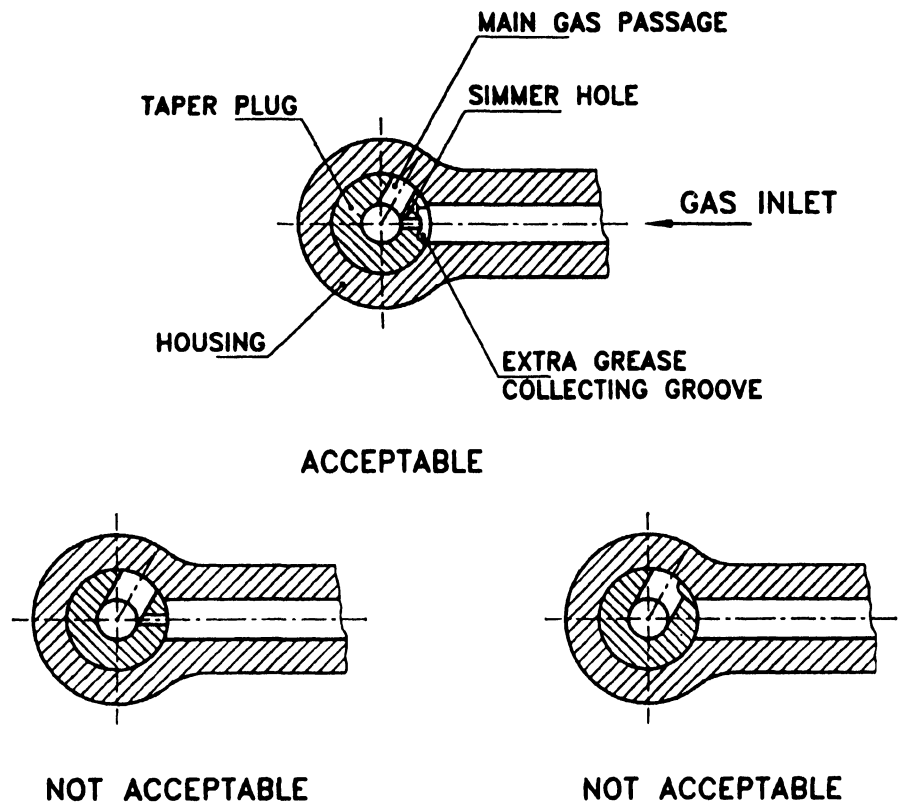
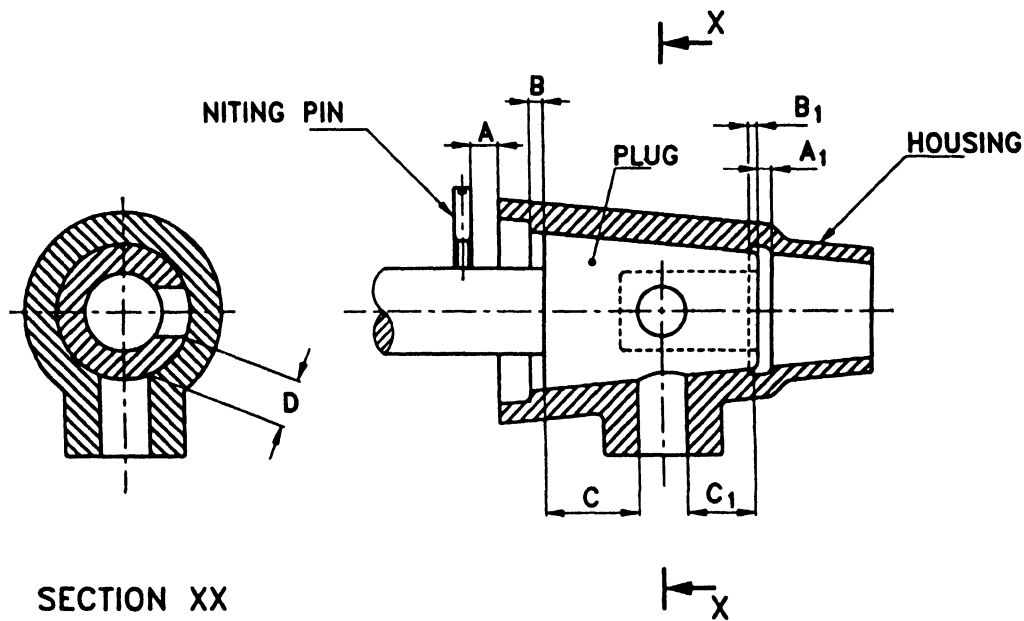


FIG. 2 SIMMER GAS-WAY IN TAPS (AXIAL FLOW)



<i>A</i>	Top take up	1.2 Min	<i>A₁</i>	Bottom take up	1.2 Min
<i>B</i>	Top ridge formation allowance	0.4 Min	<i>B₁</i>	Bottom ridge formation allowance	0.4 Min
<i>C</i>	Bearing surface above gasway	3.0 Min	<i>C₁</i>	Bearing surface below gasway	3.0 Min
<i>D</i>	Circumferential seal	2.80 Min			

All dimensions in millimetres.

FIG. 3 DETAILS OF GAS COCK ALLOWANCES

9.3 If the body of the stove is electroplated, the top flat surface shall have a coating of a minimum of 10 microns of nickel followed by 0.2 microns of minimum chromium. The coating shall be tested as per the requirements given in 9.3.1, 9.3.2 and 9.3.3.

9.3.1 The thickness of nickel plating shall be determined by BNF jet method or any other method, such as coulometric method as specified in IS 3203.

9.3.2 Adhesion Test

Cut a piece of a plated article, hold it in a vice and apply a coarse file to the cut edges in such a manner as to raise the deposit. There shall be no separation between the coating and the basis metal and the coating shall continue to adhere to the basis metal.

9.3.3 Corrosion Resistance Test

The plated article shall be subjected to the test for 12 h as covered in IS 6910. The rating shall be assigned using the methods described in IS 6009.

9.4 Paints or Similar Finishes

Surfaces finished in stoving paints or similar material shall conform to the following requirements:

- a) *Resistance to Abrasion* — Painted surface shall be tested for resistance to scratching as described below:

The apparatus required for this test shall be as per Fig. 4 with a 1 mm diameter steel ball fixed at the end of the counterpoised arm, which is kept horizontal.

Method of Test — Apply the apparatus to the surface under test and move the ball after loading with not less than 1 500 g, 3 to 4 cm/s relative to the surface. If the indicator bulb lights, the surface is deemed to have been penetrated. For metallic paints, a visual examination of the scratch is necessary in order to determine whether the film has been penetrated. The finish is deemed to have failed if the scratch has jagged edges, is greater than 1 mm width or penetrates the film. Clean the ball after each test and inspect frequently to verify that it is 1 mm sphere.

- b) *Resistance to Heating* — When the appliance is operated at its normal working pressure for a continuous period of 8 h with a pan filled with water placed on the burner, there shall be no appreciable change of colour of any part of the stove and the finish shall not become tacky or show other signs of deterioration. This does not apply to parts, which come into direct contact with the flame. After the initial burning off period, there shall be no detachable

odour from the flame when the stove is operated normally.

NOTE — Alternatively the body of the stove can be kept in an oven maintained at $80 \pm 5^\circ\text{C}$ for 8 h for checking the conformity.

9.5 Concealed Gas Supplies

Concealed tubular fittings liable to corrode shall be protected by bituminous paint or other equally protective material.

9.6 Screws, Nuts, Bolts and Springs

All springs and those screws, nuts and bolts which are visible or which are to be removed for maintenance shall be of corrosion-resistant material or treated to resist corrosion.

10 INJECTOR JETS

10.1 Injector jets shall be of fixed calibrated type and it shall not be possible to loosen them without the use of tools. The dimensions of the injector jets shall conform to the following requirements:

Across flat	: 10 mm, <i>Min</i>
Projection from the face of mounting	: 6 mm, nominal
Threads	: M 8 × 1

10.1.1 The injector jet shall be made of metal, with or without ceramic tip. The melting point of the metal shall be not less than 650°C .

10.2 The size of the jet in litres per hour of flow of biogas at STP conditions shall be impressed upon it.

11 BURNERS

11.1 The construction of burners and the assembly shall allow their dismantling from the supports without the use of tools (see Fig. 5 for guidance).

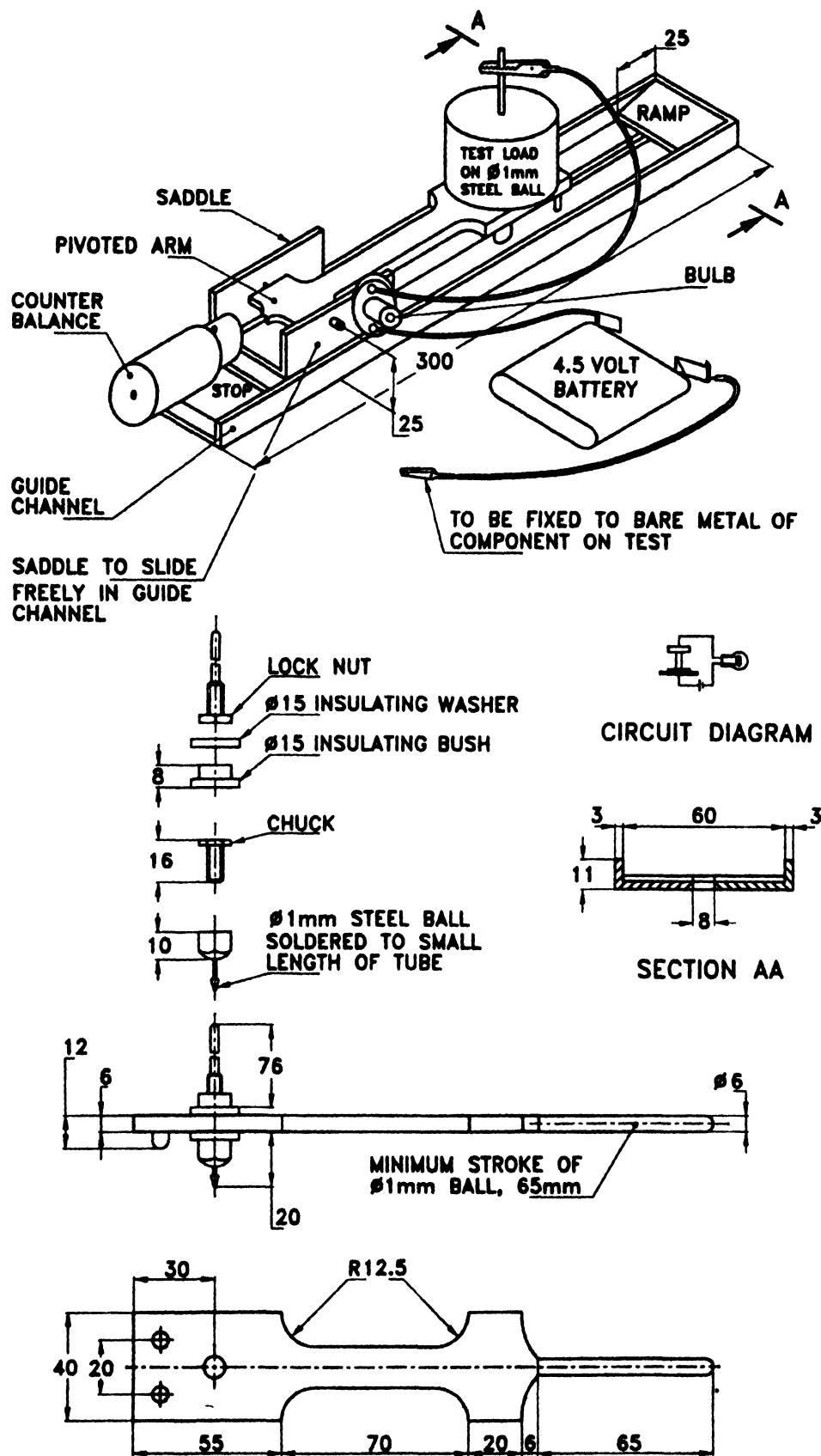
11.2 The burner supports shall be rigid and shall be fixed in their place. Their construction shall ensure the stability of the burners and shall prevent their undue movement in a horizontal plane.

11.3 The tightness of the joints in a burner assembly shall not depend upon adhesives or any kind of packing.

11.4 In the case of stoves having more than one burner, one of the burners shall be of at least 450 l/h rating at STP.

11.5 For burners having centre flame, provision shall be made to protect the centre flame from pans resting directly on burner top and smothering it.

11.6 If ... more pan ... to provide proper self-locating arrangement so that the ...



All dimensions in millimetres.
FIG. 4 PAINT SCRATCH TEST APPARATUS

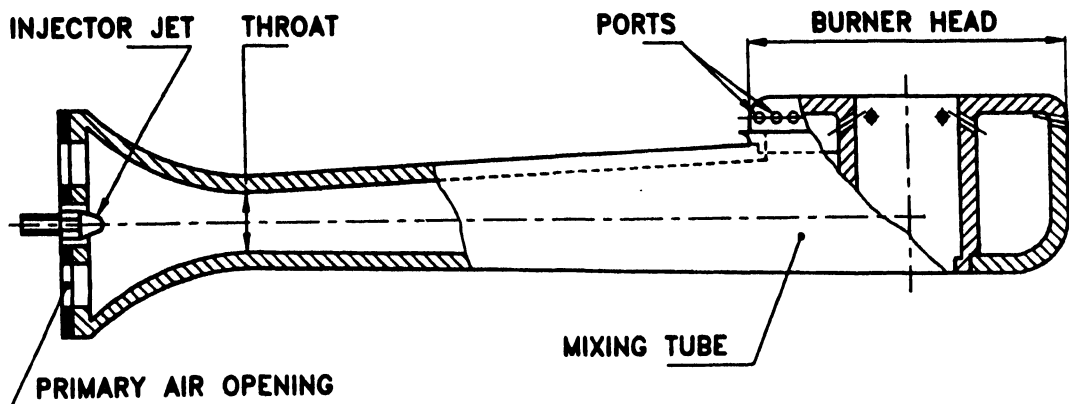


FIG. 5 BURNER ASSEMBLY

reassembled to its original design preventing any maladjustment in their assembly. This shall also be applicable for primary air regulators.

12 PAN SUPPORT

12.1 The design of the pan supports shall be such that it is practicable to support a pan of 125 mm diameter over at least one burner of the stove without the use of the loose rings and such that 150 mm diameter vessel remains stable over each burner. Prongs of the support shall have suitable taper to accommodate round bottom pans.

12.1.1 Loose pan supports shall be so designed that it is not possible to place them firmly in other than proper position.

13 GAS INLET CONNECTIONS

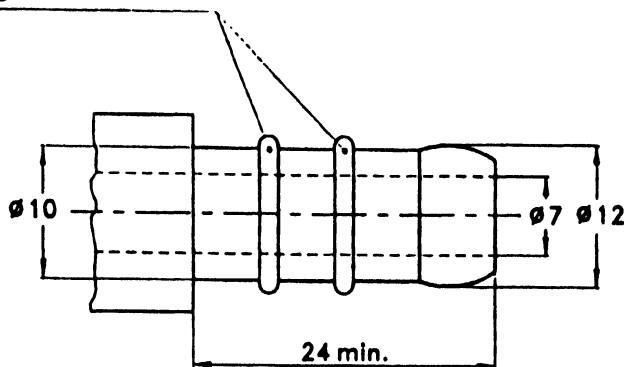
13.1 Where nozzles for flexible tubing are fitted, they shall be positioned so as to facilitate the fitting of the tubing and also to prevent heating of the tubing to more than 60°C. Shape of nozzle is given in Fig. 6.

13.1.1 The pipe/tube used for main gas rail shall be of mild steel. The minimum wall thickness of the main gas rail shall be 1.6 mm + no limit/ -0.15 mm. The external surface of the gas rail shall be treated to resist corrosion. Any other connection made from the main gas rail shall be only metallic.

13.1.2 Screwed gas inlet and outlet connections shall conform to IS 554.

13.2 The position of the gas inlet shall allow connection to a gas supply on either side of the appliance with

TWO EQUALLY SPACED (APPROX.)
EXPANDED AREAS OF APPROX.
WIDTH 1.5 AND WITH ROUNDED
CORNERS



TOLERANCE ON ALL DIMENSIONS + 0.1

All dimensions in millimetres.

FIG. 6 INLET NOZZLE

appliance fitted tight against a back wall. It shall be possible to change gas inlet from left to right easily by standard tools.

14 GAS SOUNDNESS

All gas carrying parts of the stove shall be sound and these parts when connected, shall conform to complete assembly which is sound against any gas leakage. The complete assembly shall be checked at 14.71 kN/m^2 (approximately 150 gf/cm^2). The details of the test are laid down in Annex E

15 STRENGTH TEST

When tested as specified in Annex F, the vertical resultant deflection of the top surface measured at the center of length of the body, shall not exceed 4 mm and the distance between the opposite side (widthwise and lengthwise) shall not change by more than 5 mm.

SECTION 2 PERFORMANCE

16 GENERAL CONDITIONS OF TEST

Stoves shall be tested under conditions simulating as closely as possible to those under which it is designed to operate. During the tests initial adjustment of stove shall not be altered unless specifically required in the test procedure. Since the composition of biogas varies with its origin, it is necessary to adjust the stove to its maximum heat conditions before it is tested. The stove shall be adjusted and operated in accordance with the instructions issued with the stove. Before any tests are made, the stove shall be operated at its full working temperature for a sufficient period to remove any temporary finish, which may interfere with observations. The gas connections and system of the stove and the burners shall be examined for leaks before and after test. The performance test results shall not be valid unless the system is sound. The stove shall be at room temperature at the start of each test unless otherwise stated. The initial temperature of the room shall be between 25 to 30°C .

17 GAS CONSUMPTION

17.1 Each burner assembly under separate 'ON/OFF' control shall give within ± 8 percent of the manufacturer's specified gas consumption in l/h at STP when tested with compressed air at inlet pressure of 747 N/m^2 (7.62 gf/cm^2).

17.1.1 Multi-burner appliance (namely, appliance having more than one burner) shall give within $+ 5$ and -15 percent of the declared total consumption in l/h at STP when all the burners are tested together with compressed air at an inlet pressure of 747 N/m^2 (7.62 gf/cm^2).

17.1.2 The gas consumption shall be measured by volume method using compressed air. The arrangement of the apparatus shall be similar to that given in Annex G. The measurements of volume shall be made with a wet gas flow meter and with minimum consumption of 30 litres. The air flow thus found shall be converted to STP (27°C and 760 mm of mercury). The air consumption thus found shall be converted to biogas consumption by multiplying 1.05.

17.2 It shall be possible to reduce the consumption rate of each of the burners to 40 percent or lower of the rated capacity.

17.2.1 When the gas consumption of a burner is reduced to simmer as described in 17.2, the flame shall not extinguish, blow off, strike back or form soot when tested with biogas at 747 N/m^2 (7.62 gf/cm^2).

18 IGNITION AND FLAME TRAVEL

There shall be easy and safe access for lighting and relighting each burner by a matchstick. With the vessel placed on the burner, if the flame is applied to any burner port and the gas is turned on, flame travel shall be complete.

19 FLAME STABILITY

It shall be possible to operate the stove with taps fully open at gas inlet pressure of 747 N/m^2 (7.62 gf/cm^2) without the flame either blowing off or striking back.

20 NOISE CONTROL

The ignition of the burner flames, their operation and turning off shall not give undue or excessive noise during operation.

21 FORMATION OF SOOT

A vessel of 200 mm in diameter and full of water shall be placed on the burner and the burner lighted at full 'ON' position of the tap with gas inlet pressure of 747 N/m^2 (7.62 gf/cm^2) for one hour. After the test, no soot (unburned carbon) shall be deposited on the burner and on the bottom of the vessel.

22 FLASHBACK

A vessel having diameter suitable to cover the pan support and filled with water shall be placed on the burner under test. The tap of the burner shall be turned on and gas shall be allowed to flow through the burner at full rate, with tap fully opened and gas lighted. After half an hour, the flame shall be immediately reduced to simmer and brought back to full size. This operation shall be repeated five times. Then the burner shall be put off and immediately reignited. This operation shall also be repeated five times. During the test, no flashback shall occur.

23 COMBUSTION

When tested in accordance with the details laid down in Annex H, on no account carbon monoxide content of the exhaust gases of any burner operating at any consumption at which the burner is stable at gas inlet pressure of 747 N/m² (7.62 gf/cm²) shall not exceed 500 parts per million (ppm).

24 SURFACE TEMPERATURE

24.1 When operated for 2 h, the temperature of no portion of the surface of the stove other than a working surface, likely to be touched accidentally, shall exceed 120°C (working surfaces include flue outlets, pan-supports and burner heads).

24.1.1 Surfaces which, in normal use, have to be touched for short periods (for example, tap handles) shall not have a temperature exceeding 60°C.

25 THERMAL EFFICIENCY

When tested by the method specified in Annex G, the thermal efficiency shall be at least 55 percent for each burner with a pan supported correctly on the burner supports, dimensions of the pans are given in Table 1.

26 CLASSIFICATION OF TESTS

26.1 The following shall constitute type tests:

- Flashback test for materials of burner (*see* 5.2),
- Strength test (*see* 15),
- Gas consumption (*see* 17),
- Combustion (*see* 23),
- Surface temperature (*see* 24), and
- Thermal efficiency (*see* 25).

26.2 The following shall be carried out as routine tests:

- Gas soundness (*see* 14),
- Ignition and flame travel (*see* 18),
- Flame stability (*see* 19),
- Noise control (*see* 20),
- Formation of soot (*see* 21), and
- Flashback (*see* 22).

SECTION 3 GENERAL

27 INSTRUCTIONS

Each stove shall be accompanied by an instruction sheet, card or leaflet giving the following information.

- Brief instructions for installation, correct operation and maintenance of the stove,
- Rating of each burner in l/h at STP;
- Total gas consumption in l/h at STP;
- Working pressure of gas, and
- Country of origin.

28 MARKING

28.1 A metallic plate incorporating the following shall be securely fixed in front of each stove:

- Manufacturer's name, initials or his registered trade-mark;
- Total gas consumption in l/h at STP,
- Rating of each burner in l/h at STP;
- Any special instructions for the safe use,
- Country of origin; and
- The words 'For use with biogas at 747 N/m² (7.62 gf/cm²)'.

Table 1 Aluminium Pans for Thermal Efficiency Test
(Clause 25)

Sl No.	Gas Rate at STP l/h	Pan Diameter (External) mm (±5 percent)	Pan Height (External) mm (±5 percent)	Total Pan Mass With Lid g (±10 percent)	Mass of Water in Pan kg
(1)	(2)	(3)	(4)	(5)	(6)
i)	000-240	180	100	356	2.0
ii)	246-300	205	110	451	2.8
iii)	306-360	220	120	519	3.7
iv)	366-420	245	130	632	4.8
v)	426-480	260	140	750	6.1
vi)	486-570	285	155	853	7.7
vii)	576-692	295	165	920	9.4
viii)	698-810	320	175	1100	11.1

NOTES

- Distilled water (*see* IS 1070) shall be used for the test.
- The pan shall be cylindrical with flat bottom
- The finish of the pan bottom from inside shall always be bright

28.2 BIS Standard Mark

The stoves may also be marked with the BIS Standard Mark.

28.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act, 1986*

and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(Clause 2)

LIST OF REFFERED INDIAN STANDARDS

<i>IS No.</i>	<i>Title</i>	<i>IS No.</i>	<i>Title</i>
292 : 1983	Specification for leaded brass ingots and castings (<i>second revision</i>)	2305 : 1988	Method for mercurous nitrate test for copper and copper alloys (<i>first revision</i>)
319 : 1989	Free cutting leaded brass bars, rods and sections — Specification (<i>fourth revision</i>)	3203 : 1982	Methods of testing local thickness of electroplated coatings (<i>first revision</i>)
410 : 1977	Cold rolled brass sheet, strip and foil (<i>third revision</i>)	4454 (Part 4) : 2001	Steel wires for mechanical springs — Specification : Part 4 Stainless steel wire (<i>second revision</i>)
554 : 1999	Pipe threads where pressure-tight joints are made on the threads — Dimensions, tolerances and designations (<i>fourth revision</i>)	6009 : 1970	Method for evaluation of results of accelerated corrosion test
737 : 1986	Wrought aluminium and aluminium alloy sheet and strip for general engineering purposes (<i>third revision</i>)	6480 : 1988	Glossary of terms relating to domestic and commercial gas-burning appliances (<i>first revision</i>)
1070 : 1992	Reagent grade water (<i>third revision</i>)	6910 : 1985	Method of testing corrosion resistance of electroplated and anodized aluminium coatings by acetic acid salt spray (AAS) test (<i>first revision</i>)
1458 : 1965	Railway bronze ingots and casting		
1570 (Part 5) : 1985	Schedules for wrought steels : Part 5 Stainless and heat-resisting steels (<i>second revision</i>)	6912 : 1985	Copper and copper alloy forging stock and forgings (<i>first revision</i>)

ANNEX B

(Clause 5.1.1)

METHOD OF TEST FOR PLASTICS COMPONENTS

B-1 METHOD

B-1.1 The test shall be made in a dry products free heating cabinet. Where the plastics is integral with, pushed on or secured to another component, the stressed condition shall either be stimulated, or where practicable, the plastics part shall be assembled to mating component.

B-1.2 Visually inspect the component to establish its initial condition. Place the stressed component in the cabinet for a continuous period of 48 h at a temperature of 60°C, after which inspect it again.

B-1.3 If during the final examination, it is observed that the plastic part has sustained by fissure, distortion, blemish or discoloration, it shall be deemed to have failed.

ANNEX C

[Clause 5.2 and 26.1(a)]

METHOD FOR FLASHBACK TEST FOR MATERIALS OF BURNERS

C-1 PROCEDURE

C-1.1 The stove under test shall be set up to operate as far as possible in the manner expected in normal use, due attention to the manufacturer's instructions. The gas supply shall be connected at an inlet pressure of 747 N/m² (7.62 gf/cm²).

C-1.2 Each burner shall be ignited in turn and maintained with the flames flashed back into the

mixing tube. The gas rate chosen for this shall be not necessarily the highest gas rate that can be accommodated in the mixing tube but the rate most likely to cause melting or distortion of the burner. The burner shall be maintained with burner top in normal position for half an hour in the flashback condition and subsequently examined for any distortion or melting.

ANNEX D

(Clause 9.2)

TEST APPROPRIATE TO VITREOUS ENAMELLED COMPONENTS

D-1 All enamelled components shall pass the tests given in **D-1.1** and **D-1.2**.

D-1.1 Citric Acid Spot Test

D-1.1.1 Apparatus

D-1.1.1.1 Dropper bottle or medicine dropper.

D-1.1.1.2 Watch glass — 25 mm in diameter with fire polished edge.

D-1.1.1.3 Towel — Made of soft cotton.

D-1.1.2 Reagents

D-1.1.2.1 Citric acid solution — Dissolve 10 g of anhydrous citric acid crystals (H₃C₆H₅O₇) in 100 ml of water. Solution shall be prepared not more than 48 h prior to use.

D-1.1.2.2 Cleaner solution — Dissolve 10 g of trisodium phosphate (Na₃PO₄) in one litre of tap water

D-1.1.3 Test Procedure

Clean the test specimen at a temperature of 100°C by means of the cleaner solution. After cleaning, the specimen shall be moistened with warm water and then tested using the citric acid solution. The specimen shall be tested in a one percent solution of trisodium phosphate. Keep

warm running tap water and dry with a soft towel by blotting. Store the specimen at a temperature of $26 \pm 1^\circ\text{C}$ for a time sufficient to bring it within this range of temperature prior to and during the test.

NOTE — If, when rinsing, water gathers in drops on the surface, repeat washing treatment until the water spreads evenly.

Select areas on the specimen that remain horizontal or nearly horizontal in service. Place the specimen in a position such that the flat area at least 38.1 mm in diameter is horizontal, with the specimen and the citric acid solution at $26 \pm 1^\circ\text{C}$, place several drops of the solution on the test area to form a pool, and immediately cover with a clean watch glass in inverted position. Use a quantity of solution that is just sufficient to fill the inverted watch glass except for a small air bubble (three to six drops are usually required, depending upon the dropper and the curvature of the watch glass). After 15 of treatment, remove the watch glass and immediately rinse the surface. Dry the specimen with dry, clean and soft cotton towel by blotting (not by rubbing).

Check the test specimen within 2 h after exposure to the test solution. Draw two or more approximately parallel lines extending across the treated area by using the flat point of conventional graphite drafting pencil of degree 3B held in a normal writing position and applied with firm pressure. Now, rub the marks with a clean, soft cotton towel, which has been dipped in water and wrung to expel any excess water. Do not use soap, abrasive or similar cleaning material.

The pencil mark shall be completely removed from treated area.

D-1.2 Impact Resistance Test

D-1.2.1 Apparatus

The apparatus shall conform to Fig. 7.

D-1.2.2 Test Procedure

Place the test specimen on the base of the apparatus and centre approximately. Then hold the specimen firmly into position with clamps. Now place the falling

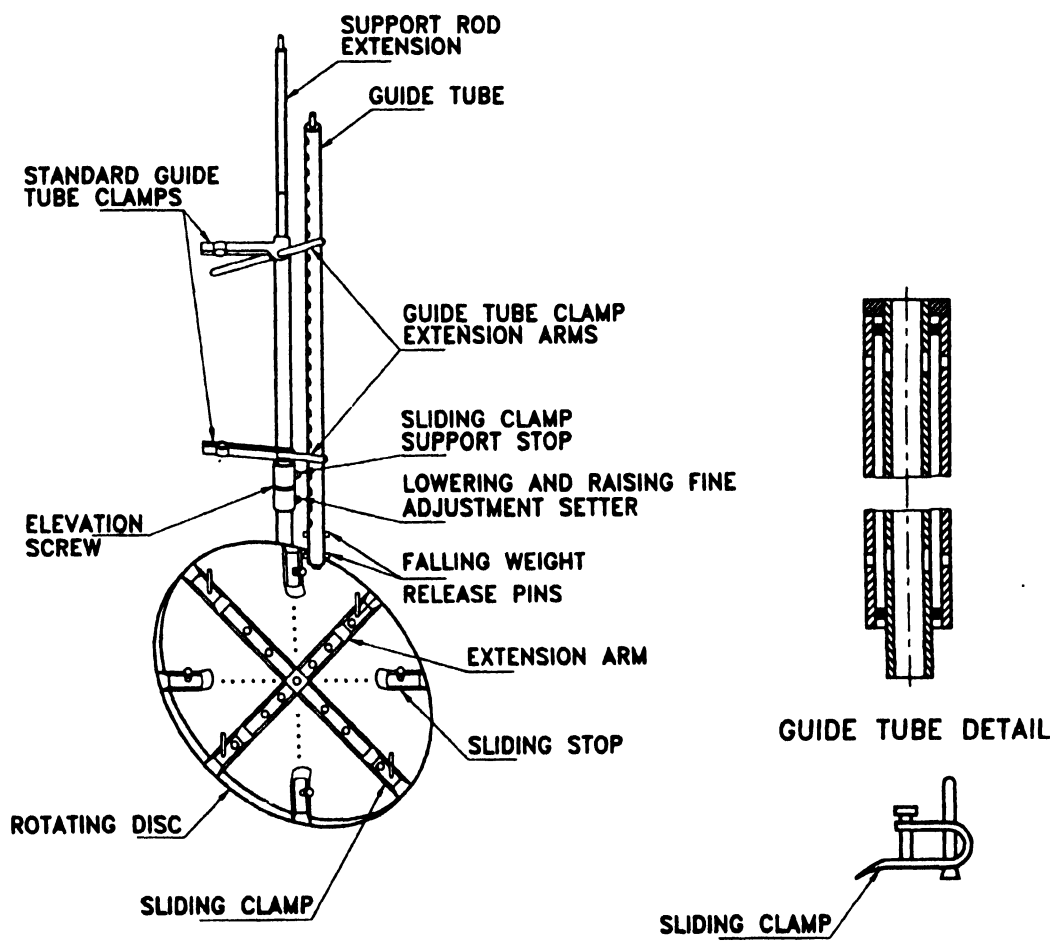


FIG. 7 IMPACT TEST MACHINE

weight, consisting of aluminium ball of 20 ± 1 mm in diameter and weighing minimum 10 g, on the release pin through the set of perforation in the guide tube, so that height of impact is 910 mm above the test specimen. Begin the test by pulling the release pin, which allows the falling weight to strike at the centre of the specimen. After the test, there should not be any chipping.

D-2 Thermal Shock Resistance Test

D-2.1 Components on which water may spill in normal use shall be tested for thermal shock resistance. The enamelled surface shall be examined for any spill in normal use signs of flaking off or cracking after undergoing cycles of test when tested by the following procedure.

D-2.1.1 Test Procedure

Subject the test specimen to radiant heat, so as to reach a steady temperature of 185 to 195°C in about 10 min in an oven. Remove the specimen within 5 s and quench the surface with 1 000 ml of water at 15 to

20°C directed from an aspirator or other container through a 5-mm diameter tube, the end of tube being 150 mm about the centre of the heated portion of the test specimen and the flow rate being adjusted to 10 ml/s (*see Note*). Dry the specimen, replace the same in position under the procedure until 6 cycles have been completed. The specimen shall not show any sign of flaking off or cracking.

NOTE — It is convenient to mark the test area to ensure that water for quenching is correctly applied

D-3 Pan supports, burners, caps and burner baffles shall be tested by the following procedure.

D-3.1 Test Procedure

Heat the components placed in position by lighting the burner in full 'ON' position with flat bottom pan containing water placed on the pan supports for half an hour. Extinguish the burner and allow the components to cool to atmospheric temperature. Repeat the heating and cooling treatment twice. At the end of the test, the component shall not show any sign of cracking, flaking and blistering.

ANNEX E

[Clause 14 and 26.2(a)]

METHOD OF TEST FOR GAS SOUNDNESS

E-1 PROCEDURE

E-1.1 The appliance shall be tested for gas soundness by the following method.

Subject the appliance to be tested to an air supply at a pressure of 14.71 kN/m² (150 gf/cm²) with the bubble leak indicator (*see Fig. 8*) in the air supply line. Apply this pressure with all the taps of the appliance closed and examine the bubble indicator for the appearance of bubbles. The interval between the successive bubbles passing through it shall not be less than 10 s. Repeat the test with all the jets of the appliance sealed and all the taps open. Repeat the two tests after the taps have been turned 'ON' and 'OFF' ten times.

E-1.2 The following method shall be used to locate the point of leakage.

Immerse the appliance to be tested or the part through which the gas flows, assembled in working condition, in a water-bath at room temperature. Then connect it to an air supply at a pressure of 150 gf/cm² for a minimum period of 10 s with all the taps of the appliance closed and the appliance or the tested parts shall be examined for leakage of air. The test shall be repeated with all the jets sealed and all the taps open. The two tests on bubble

between the successive bubbles passing through it shall not be less than 10 s

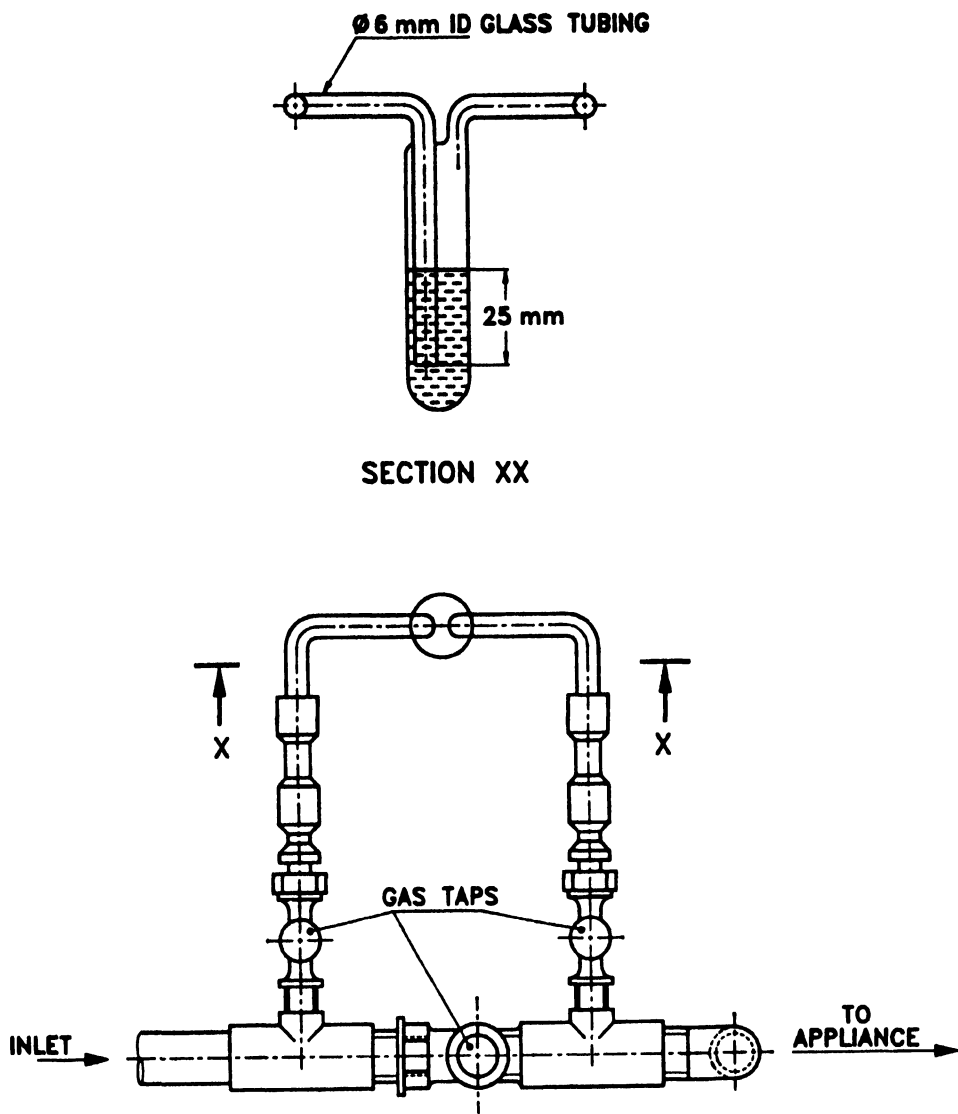


FIG. 8 BUBBLE LEAK INDICATOR

ANNEX F

[Clause 15 and 26.1(b)]

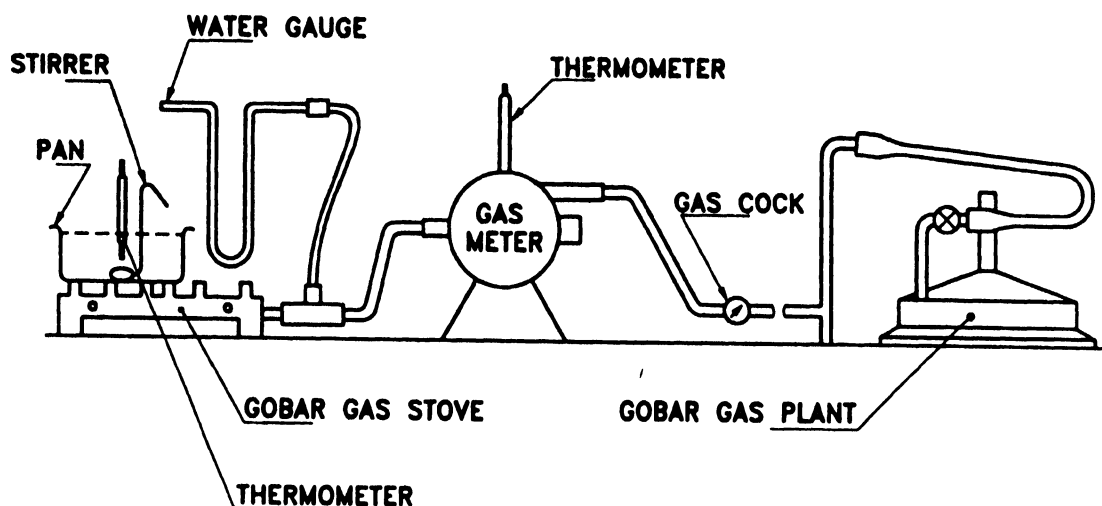
STRENGTH TEST

F-1 PROCEDURE

F-1.1 The rubber support (grommet), if any, shall be removed and replaced with identical metal supports. The pan support and burner shall be removed and the distance between the sides of the appliance body being tested shall be measured.

A reference reading at the top surface of the body at the centre of the length shall be taken. A load of 250 N (25 kg) per burner shall be applied at the top surface subject to a minimum load of 500 N (50 kg)

for a single burner stove. The load shall be applied without impact to a plate of steel having 20 mm thickness, 100 mm width of as long as the length of the appliance (*see* Fig. 9). This plate shall be placed in the centre of the top surface of the appliance and its length parallel to the front. The load shall be maintained for 5 min after which the measurement for deflection at centre of the length as close as to the front of the plate possible on solid top surface shall be taken with load in position.

FIG. 10 THERMAL EFFICIENCY TEST FOR *GOBAR* GAS STOVE

flowing through the gas meter as well as the atmospheric pressure shall be recorded. The gas tap shall be turned 'ON' and gas lighted. The water in pan shall be allowed to warm steadily until it reaches a temperature of about 80°C, then stirring commenced and continued until the end of the test. When the water temperature reaches $90 \pm 1^\circ\text{C}$, the gas shall be turned 'OFF'. The stirring shall be continued and the maximum temperature (t_2) shall be recorded. The quantity of gas used during the test shall be deduced by observing the wet meter.

G-2.3 The useful heat obtained from the burner is the mass of the water used in kilograms plus water equivalent of vessel with the lid and stirrer, multiplied by the temperature rise in degree celsius obtained. The heat input into the appliance is the corrected volume of gas used in litres, multiplied by calorific value of the gas used in kcal/litre. The thermal efficiency shall be calculated by the following formula:

$$e = \frac{100(G + W)(t_2 - t_1)}{VH}$$

where

- e = thermal efficiency of the burner in percent,
- G = quantity of water in the vessel in kg,
- W = water equivalent of the vessel complete with lid and stirrer,
- t_2 = final temperature of water in $^\circ\text{C}$,
- t_1 = initial temperature of water in $^\circ\text{C}$,

V = gas consumption in litres, and

H = calorific value of the gas in kcal/l.

G-3 In performing the thermal efficiency test the following points shall be noted:

- a) Only one burner at a time is tested;
- b) The set up shall be carefully checked for leaks, before and after the test. If a leak is found after the test, the results are cancelled and the test repeated;
- c) It may be necessary to place a screen around the appliance during this test in order to exclude the effects of draught and its distance from the vessel shall be 100 mm;
- d) The initial water temperature shall be within $\pm 2^\circ\text{C}$ of the actual room temperature;
- e) The initial temperature of the room shall be between 25 to 30°C .
- f) The net calorific value is used (see G-1.4);
- g) At the start of the test, the burner is at room temperature;
- h) The temperature of water is obtained by means of mercury-in-glass thermometer, of accuracy of 0.5°C , the bulb of which is immersed to half the depth of the water in the vessel;
- j) Stirring effected by means of a horizontal loop of 3 mm metal rod attached to an upright which passes through a 6 mm hole drilled in the lid.

ANNEX H*[Clauses 23 and 26.1(d)]***TEST METHOD FOR DETERMINATION OF
CARBON MONOXIDE/CARBON DIOXIDE RATIO****H-1 PROCEDURE**

The stove shall be set up in the manner described under 16. Before starting the test, a pan of 190 mm diameter and suitable height, and containing water sufficient for the test shall be placed over the stove. In addition, a collecting hood suitable for the stove under examination shall be obtained. The hood shall be so designed that while not interfering in any way with the normal combustion of the stove, it collects a fairly high proportion of the products of combustion. Also, it shall be such that the sample collected represents

the whole of the combustion gases and not those from any particular point. When using hood, the damper provided shall be set or additional flue pipe added so that spillage of the flue gases around the skirt is just prevented. With the sample hood in position over the stove under investigation test gas at inlet pressure of 747 N/m^2 (7.62 gf/cm^2) shall be admitted and stove operated for ten minutes before the sampling is commenced. Any of the recognized methods may be used for gas analysis.

ANNEX J

(Foreword)

COMMITTEE COMPOSITION

Domestic and Commercial Gas Burning Appliances (Pressure Type) Sectional Committee, ME 23

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